

PAT APPL  
IN-37 69467  
NASA CASE NO. LAR 14169-1 P-8

PRINT FIG. 1

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LaRC

(NASA-Case-LAR-14169-1) SUBSTANTIALLY  
OXYGEN-FREE CONTACT TUBE Patent Application  
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## SUBSTANTIALLY OXYGEN-FREE CONTACT TUBE

NASA Case No. LAR 14169-1

Arc welding processes such as gas metal arc welding (GMAW) and flux core arc welding (FCAW) use contact tubes to guide and provide electrical contact with a consumable electrode wire. Contact tubes made of conventional copper alloys are subject to deterioration as a result of electrical erosion.

Substitution of a substantially oxygen-free conductive alloy for the manufacture of contact tubes results in decreased electrical erosion by reducing the amount of oxide formation. Use of a substantially oxygen-free copper alloy results in increases in wear life of up to 37%.

The novelty of the present invention encompasses its ability to increase contact tube wear life by decreasing the degree of oxide formation due to electrical erosion.

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SUBSTANTIALLY OXYGEN-FREE CONTACT TUBE

Origin of the Invention

- 5           The invention described herein was made by employees of the United States Government and may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefor.

10   Background of the Invention

1.   Field of the Invention

- This invention relates generally to arc welding and more specifically to  
15   a contact tube improvement to reduce the degree of electrical erosion.

2.   Description of the Related Art

- Arc welding processes such as gas metal arc welding (GMAW), flux  
20   cored arc welding (FCAW) and submerged arc welding (SAW) use continuously-fed consumable electrodes. These electrodes are guided through and maintain contact with a contact tube which also acts to transfer current to the electrode. Because of their function in transferring current, the tubes must have high conductivity and therefore are generally manufactured from copper  
25   alloys. Contact tubes are considered an expendable component which must be periodically replaced as a result of abrasive wear and electrical erosion which cause deterioration of the tubes. Because of this deterioration, the welding industry has long sought various means for increasing the useful life of the contact tubes. Although electrical erosion has been identified in the art  
30   as a source of deterioration, applicant is unaware of related art identifying the

underlying cause of this phenomenon.

### Summary of the Invention

5           It is a primary object of the present invention to provide a device for transferring current to a continuously-fed consumable electrode which has an increased wear life due to a reduction in electrical erosion. Additional objects and advantages of the present invention are apparent from the specifications and drawings which follow.

10           The foregoing objects are achieved by manufacturing the contact tube from a substantially oxygen-free copper alloy. Selection of an oxygen-free copper was based on results of metallurgical analyses conducted by the applicant of contact tubes presently used in the art. These analyses revealed high concentrations of oxides in the regions of the contact tubes affected by  
15           electrical erosion.

          Beneficial results have been obtained by limiting the oxygen content to a maximum of approximately .001% by weight. Use of this type of alloy has been shown to increase the wear life of a specific contact tube by approximately 37%.

20           Contact tubes manufactured with this substantially oxygen-free copper alloy are suited to a variety of arc welding processes such as GMAW, FCAW and SAW which use contact tubes to transfer electrical current to a continuously-fed consumable electrode wire.

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Brief Description of the Drawing

FIG. 1 is a schematic drawing of a portion of a welding gun containing a contact tube and a continuously-fed electrode wire.

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Description of the Preferred Embodiments

Referring to FIG. 1, a contact tube **10** is housed within a welding gun nozzle **30**. The contact tube **10** acts both to guide a continuously-fed electrode wire **20** and to transfer current to the electrode wire **20**. Current is provided by means of a conventional power supply.

Although FIG. 1 depicts a hollow, cylindrical contact tube **10** through which the electrode wire **20** is guided, this is only a illustrative design. The present invention applies to any type and shape of contact tube which maintains contact with the wire in order to transfer current. Any suitable guiding mechanism can also be employed.

Metallographic examination by the applicant of a contact tube **10** made from a conventional copper alloy indicated the occurrence of electrical erosion at the contact tip **10a** of the tube. This region of erosion was associated with an increased incidence of oxides. To reduce the oxide occurrence, contact tubes **10** were manufactured from a substantially oxygen-free copper alloy in which the oxygen content was maintained below approximately .001% by weight. The reduced oxygen content resulted in an approximately 37% increase in the wear life of contact tubes which were tested. Further decreases in the concentration of oxygen may be used to achieve higher levels of wear life. According to the present invention, substantially reducing the oxygen in any conductive alloy susceptible to electrical erosion due to the formation of oxides should significantly enhance the wear life of the contact tube **10**.

Although the present invention has been described in detail with respect to certain preferred embodiments thereof, it is understood by those of skill in

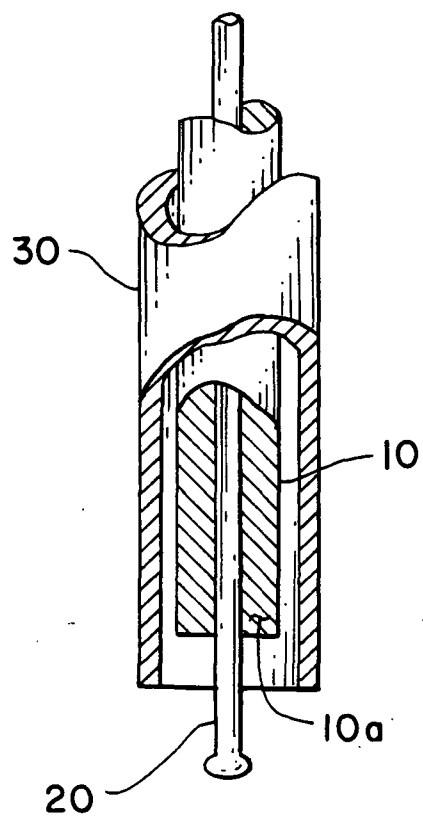
the art that variations and modifications in this detail may be made without any departure from the spirit and scope of the present invention, as defined in the hereto-appended claims.

What is claimed is:

SUBSTANTIALLY OXYGEN-FREE CONTACT TUBE

Abstract of the Disclosure

- 5        A device for arc welding is provided in which a continuously-fed electrode wire is in electrical contact with a contact tube. The contact tube is improved by using a substantially oxygen-free conductive alloy in order to reduce the amount of electrical erosion.





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